

Water Quality at Timucuan Ecological and Historic Preserve: Baseline Data and Management Implications

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Background

Tidal creeks contain critical habitat for a variety of fish, and wildlife species. They serve as nursery habitats for fish, crustaceans, and shellfish and foraging habitat for birds and mammals while providing a multitude of recreational opportunities including boating, fishing, and bird watching.

Timucuan Ecological and Historic Preserve (TIMU), contains hundreds of miles of tidal creek habitat and covers approximately 46,000 acres between the St. Johns River and the Nassau River. The entire preserve is located within Duval County and the city limits of Jacksonville, FL. Because of its location, TIMU faces many anthropogenic threats to water quality including contaminants from agricultural, industrial, and residential land uses. In 2004, TIMU management teamed with the State of Florida Department of Environmental Protection to begin a long-term water quality monitoring program. In March 2004, a water-quality datalogger was deployed off of the Kingsley Plantation dock (Figure 1). This device recorded water temperature, salinity, pH, dissolved oxygen, depth, and turbidity at half-hour intervals.

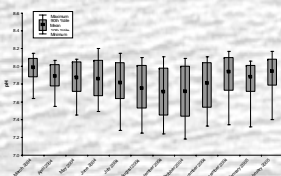


Figure 2. Monthly Summary of pH at Kingsley Plantation Site.

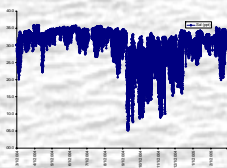


Figure 3. Salinity Data from Kingsley Plantation Site.

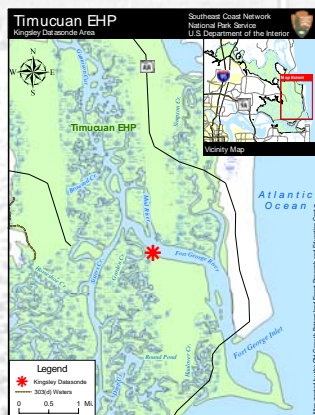


Figure 1. Timucuan Ecological and Historic Preserve, Kingsley Plantation Site.

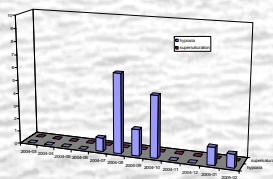


Figure 4. Hypoxia and Supersaturation events at Kingsley Plantation Site.

Discussion

These data provide baseline water-quality information for TIMU at the Kingsley Plantation site. As development pressures adjacent to and within the preserve increase, baseline water quality data like these will be crucial for making informed management decisions aimed towards protecting this valuable resource.

Water quality data collected in this study suggest that the tidal creeks near the Kingsley Plantation site are not well flushed. Creek pH (Figure 2) falls within a very narrow range (7.2 – 8.2), suggesting a highly buffered system with limited freshwater input. After Hurricane Francis (September 5-7, 2004) passed through the area, salinity remained extremely variable until December (Figure 3). This indicates that freshwater flushing of this system is slow, in this case, several months. Because of the protracted flushing time within TIMU tidal creeks, preventing the inflow of contaminants and excess nutrients will be paramount to the long-term management and protection of Park water resources.

There were several short hypoxic events recorded during this year of sampling (Figure 4). The majority of these incidents occurred during the summer period, which is very common for tidal creeks in this region. In fact, short hypoxic periods benefit these valuable nursery habitats by creating a temporary refuge for small crustaceans and crabs from some predators. On the other hand, severe or long-lasting hypoxic events may indicate nutrient enrichment and eutrophication issues. Continued measurement of dissolved oxygen in TIMU creeks can be a useful indicator of environmental degradation.

Methods and Results

Data were collected beginning in March 2004, with a YSI 6600 multiparameter sonde unit. Methods for instrument calibration followed standard manufacturer protocols. Environmental variables (temperature, salinity, pH, dissolved oxygen, depth, and turbidity) were recorded every 30 minutes. Sample collection and data analysis followed protocols established by the National Estuarine Research Reserve Program (Arendt et al., n.d.; Wenner et al., 2004). This analysis includes data from March 2004 to March 2005.

The water-quality datalogger was deployed on average 10.6 days between calibrations. The shortest field deployment was 2 days (July 2004), while the longest was 24.8 days (January 2005). Short deployment times, especially during the warmer seasons, prevented significant fouling on the instrument probes. In total, the device recorded nearly 17,000 values for each parameter. Parameter results include:

- **pH:** pH ranged from 7.2 to 8.2 with values above 8.0 21% of the time.
- **Temperature:** Water temperatures ranged from 9.7 °C to 30.9 °C. Temperatures exceeded 25 °C in 40% of the measurements.
- **Depth:** Mean depth at this site was 4.0 m and showed a mean daily tidal range of 1.54 m. The minimum recorded depth was 2.6 m (December), and the maximum was 5.4 m (November).
- **Turbidity:** Minimum and maximum turbidities were 0.1 NTU and 1,860.2 NTU, respectively. Turbidity was greater than 25 NTU (i.e., the federal standard) approximately 3% of the time.
- **Salinity:** Mean daily salinity was 29.4 ppt with the mean salinity range being 7.75 ppt. The lowest salinity occurred in September immediately after Hurricane Francis (5.2 ppt) and the highest occurred in March (35.9 ppt).
- **Dissolved Oxygen (DO):** Minimum percent DO saturation observed was 5.4% (July) and highest was 139.3% (January). Over the year, several hypoxic events (DO < 28%) were observed. These occurred primarily in Summer/Fall but were rare (up to 6% of deployment) and short (none of these events lasted longer than 12 hours).

References

- Arendt, M., Snoots, T., and Chen, Y., n.d. *A Manual Demonstrating use of MS Access and MS Excel for Synthesizing Water Quality Data from the NERR System-Wide Monitoring Program*. South Carolina Department of Natural Resources, 34p.
- Wenner, E., Sanger, D., Arendt, M., Holland, A.F., and Chen, Y., 2004. Variability in Dissolved Oxygen and Other Water-Quality Variables Within the National Estuarine Research Reserve System. *Journal of Coastal Research*, 45, 17-38.

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